

Keck Institute for Space Studies

List of Study Programs

2024 Programs:

1. [Sample return from all across the Solar System](#)
2. [Metasurface Optics for High-Contrast Imaging: Design, Fabrication, and Implementation](#)
3. [Forging Community Consensus for an Integrated GHG and Winds Mission](#)
4. [Digital Twins for Solar System Exploration: Enceladus](#)
5. [Astronomical Optical Interferometry from the Lunar Surface](#)

2023 Programs:

1. [Blazing Paths to Observing Stellar and Exoplanet Particle Environments](#)
2. [Determining the Interior Structure of Uranus: A Case Study for Leveraging Cross-Discipline Science to Answer Tough Questions](#)
3. [The Biology of Biosignature Detection](#)
4. [Managing Soil Organic Carbon for Climate Change Mitigation: Multiscale Quantification Through Remote Sensing, AI and Biogeochemical Models](#)

2022 Programs:

1. [Exploring Exoplanets with Interferometry](#)
2. [Developing a Continuity Framework for Satellite Observations of Climate](#)
3. [Targeting Microhabitats for Life Detection](#)
4. [Enabling Fast Response Missions to NEOs, ISOs, and LPCs](#)
5. [Caltech Space Challenge 2022 \(Student-Led Program, Co-Sponsored\)](#)

2020 - 2021 Programs:

1. [COVID-19: Identifying Unique Opportunities for Earth System Science](#)
2. [Next Generation Planetary Geodesy](#)
3. [The Next-Generation Ground-Based Planetary Radar](#)
4. [Venus In-Situ Sample Capture Mission](#)
5. [Revolutionizing Access to the Martian Surface](#)
6. [Non-Nuclear Exploration of the Solar System](#)
7. [Real Time Detection and Tracking of Fires that Matter](#)

2019 Programs:

1. [Beyond Interstellar: Extracting Science from Black Hole Images](#)
2. [Nebulae: Deep-Space Computing Clouds](#)
3. [Sensing Forest Water Dynamics from Space: Towards Predicting the Earth System Response to Droughts](#)
4. [Data-Driven Approaches to Searches for the Technosignatures of Advanced Civilizations](#)
5. [Caltech Space Challenge 2019 \(Student-Led Program, Co-Sponsored\)](#)

2018 Programs:

1. [MarsX: Mars Subsurface Exploration](#)
2. [Unlocking a New Era in Biodiversity Science: Linking Integrated Space Based and In-Situ Observations](#)
3. [Tidal Heating – Lessons from Io and the Jovian System](#)
4. [Large Constellations and Formations for Exploring Interstellar Objects and Long-Period Comets](#)

2017 Programs:

1. [Accessing the Subsurface Oceans of Icy Worlds](#)
2. [Cryogenic Comet Sample Return – Compelling New Science vs. Technological Challenges](#)
3. [Designing Future CMB Experiments](#)
4. [Next-Generation Approach for Detecting Climate-Carbon Feedbacks: Space-Based Integration of Carbonyl Sulfide \(OCS\), CO₂, and SIF](#)
5. [The Architecture of LISA Science Analysis: Imagining the Future](#)
6. [Unlocking the Climate Record Stored within Mars' Polar Layered Deposits](#)
7. [Caltech Space Challenge 2017 \(Student-Led Program\)](#)

2016 Programs:

1. [Addressing the Mars ISRU Challenge: Production of Oxygen and Fuel from CO₂ Using Sunlight](#)
2. [Exoplanet Imaging and Characterization: Coherent Differential Imaging and Signal Detection Statistics](#)
3. [Optical Communication on SmallSats – Enabling the Next-Era in Space Science](#)

2015 Programs:

1. [Don't Follow \(Just\) the Water: Does Life Occur in Non-Aqueous Media?](#)
2. [Exploring New Multi-Instrument Approaches to Observing Terrestrial Ecosystems and the Carbon Cycle From Space](#)
3. [Methane on Mars](#)
4. [Optical Frequency Combs for Space Applications](#)
5. [Three Dimensional \(3D\) Additive Construction for Space using In-Situ Resources](#)
6. [Caltech Space Challenge 2015 \(Student-Led Program\)](#)

2014 Programs:

1. [Adaptive Multi-Functional Space Structures for Micro-Climate Control](#)
2. [Bridging the Gap: Observations and Theory of Star Formation Meet on Large and Small Scales](#)
3. [Gazing at the Solar System: Capturing the Evolution of Dunes, Faults, Volcanoes and Ice from Space](#)
4. [Mapping and Assaying the Near Earth Object Population Affordably on a Decadal Timescale](#)
5. [Science and Enabling Technologies to Explore the Interstellar Medium](#)
6. [Venus Seismology](#)

2013 Programs:

1. [Airships: A New Horizon for Science](#)
2. [Inferring Thermal and Mechanical Properties of Celestial Bodies Regolith Using \(Simple\) Low-T](#)
3. [New Approaches to Lunar Ice Detection and Mapping](#)
4. [Planetary Magnetic Fields: Planetary Interiors and Habitability](#)
5. [Satellites to the Seafloor: Autonomous Science to Forge a Breakthrough in Quantifying the Global Ocean Carbon Budget](#)
6. [The Sleeping Giant: Measuring Ocean Ice Interactions in Antarctica](#)
7. [Caltech Space Challenge 2013 \(Student-Led Program\)](#)

2012 Programs:

1. [CMB Polarization Cosmology in the Coming Decade](#)
2. [Engineering Resilient Space Systems](#)
3. [In Situ Science and Instrumentation for Primitive Bodies](#)
4. [New Methods to Measure Photosynthesis from Space](#)
5. [Quantum Communication, Sensing and Measurement in Space](#)
6. [Small Satellites: A Revolution in Space Science](#)
7. [Tools and Algorithms for Sampling in Extreme Terrain \(Student-Led Program\)](#)

2011 Programs:

1. [Asteroid Return Mission Study](#)
2. [Digging Deeper: Algorithms for Computationally-Limited Searches in Astronomy](#)
3. [High Altitude Ballooning for Space and Atmospheric Observation \(Student-Led Program\)](#)
4. [Monitoring of Geoengineering Effects and their Natural and Anthropogenic Analogues](#)
5. [Next Generation UV Instrument Technologies Enabling Missions in Astrophysics, Cosmology and Planetary Sciences](#)
6. [xTerramechanics - Integrated Simulation of Planetary Surface Missions](#)
7. [Caltech Space Challenge 2011 \(Student-Led Program\)](#)

2010 Programs:

1. [Future Missions to Titan: Scientific and Engineering Challenges](#)
2. [Innovative Approaches to Planetary Seismology](#)
3. [Innovative Satellite Observations to Characterize the Cloudy Boundary Layer](#)
4. [Quantifying the Sources and Sinks of Atmospheric CO₂](#)
5. [The First Billion Years](#)

2009 Programs:

1. [Climate Feedbacks and Future Remote Sensing Observations](#)
2. [Innovative Approaches to Exoplanet Spectra](#)
3. [Innovative Concepts in IR/Submm Astronomy from Space](#)
4. [Mission Concepts for Accessing and Sampling High-Risk Terrains on Planetary Surfaces](#)
5. [Monitoring Earth Surface Changes from Space](#)
6. [Shedding Light on the Nature of Dark Matter](#)
7. [Single Photon Counting Detectors](#)

2008 Programs:

1. [Coherent Arrays for Astronomy and Remote Sensing](#)
2. [Large Space Structures](#)
3. [New Directions in Robotic Exploration of Mars](#)